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## ORIGINAL MEMOIRS.

### CANCER OF THE MOUTH AND TONGUE.*

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THE anatomical and physiological conditions which are to be reckoned with in operations upon the mouth and tongue combine to make the problem of surgical interference in this region more complicated than in almost any other portion of the body. This becomes evident at once when we review the great variety of operations which have been developed for the radical cure of cancer. It has been the aim of the reporter to refer briefly to the modern methods adopted with this end in view, and to present such data as are suggestive of the lines along which the operation of the future is to be worked out, and the operative surgery for cancer in this region placed upon an equality with that designed for the treatment of cancer in other regions of the body. A brief statement is, therefore, presented of the recent studies of the lymphatic system of the tongue and mouth as viewed from a surgical standpoint; also a consideration of the conditions which have been thought to predispose to cancer, the evolution of the operative treatment, and, finally, the results obtained by operation in the service of a general hospital.

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The statistical data on which this paper is based are derived from the study of 172 consecutive cases of cancer of the tongue and mouth which appear in the records of the Massachusetts General Hospital during the 15 years from 1890 to 1904, inclusive.[1] Only cancers of the tongue and mucous surfaces of the mouth have been considered. Sarcoma, cancer of the upper jaw arising in the antrum, adamantine epitheliomata, and other tumors originating in the dental membranes have been excluded, together with all cases in which pathological examination did not confirm the diagnosis, or recurrence and metastasis did not prove the diagnosis to be correct.

## ANATOMY.

There have been no notable contributions to the existing knowledge of the gross anatomy of the muscles, blood-vessels, nerves and mucous membranes of the tongue and floor of the mouth, in recent years, but the lymphatic vessels and lymph-nodes of this region have been made the subject of special study by Poirier, Kuttner, Crile and others, particularly with a view to the relation between these structures and the operative surgery of cancer of this portion of the body. A brief summary of the existing knowledge of these lymphatics may be made as follows:

The lymphatic capillaries on the dorsum of the tongue form a delicate network in the anterior part of that organ, which becomes coarser toward the base, and surrounds the papillæ circumvallatæ at their posterior margin. Along the borders of the tongue, this network gives off tree-like branches which constitute the origin of a series of lymph-trunks running to different groups of lymphatic glands. There is a sharp line of separation between this system and that which drains

[1] These cases have been collected and analyzed by Drs. R. B. Greenough, C. C. Simmons and R. M. Green, by the consent of the Visiting Surgeons and with the assistance of the Administrative Department of the hospital, and the statistics will be published later in more detail. No cases operated upon since 1904 have been included, in order that at least three years' time may have elapsed after every operation.

the base of the tongue, and the space between it and the epiglottis, bounded laterally by the tonsils. The capillary lymphatics of this latter region have an entirely distinct point of fetal origin; the lymph from this region is collected into two large vessels on either side behind the tonsils, which pass through the muscles of the pharynx and empty into the superior deep cervical glands.

The lymphatic vessels given off from the border and under surfaces of the tongue are more numerous in front. One vessel is deserving of special notice, for it runs from the neighborhood of the frenum, forming a long loop along the outer border of the omohyoid muscle, and reaches the deep cervical glands low down in the neck, thus forming an almost direct route from the chin to the clavicle. The remainder of the lymphatic vessels from the border of the tongue pass through the submaxillary group of lymphatic glands, and empty into the largest of the superior deep cervical glands lying near the bifurcation of the common carotid. The lymph-trunks from the dorsum of the tongue follow in a general way the course of the lingual artery, but in the middle line some vessels run through one or two small glands between the geniohyoglossus muscles, and communicate, some with the superior and some with the inferior group of deep cervical glands.

The superficial lymphatics of the tonsils and upper portion of the pharynx communicate almost directly with the deep cervical glands, while the mucous membrane covering the cheek and the alveolar process of the upper jaw is drained more directly into the submaxillary group.

There may be said to be four groups of lymphatic glands which are of special interest to us surgically in connection with cancer of this portion of the body. These may be described as (1) the lingual group; (2) the submaxillary group; (3) the superior deep cervical group; and, (4) the inferior deep cervical group.

The *lingual group* is composed of glands lying on the mylohyoid muscle and between the geniohyoglossi, and occa-

sionally near the terminal portion of the lingual artery. The glands are in close relation with the group of muscles which form the diaphragm of the mouth, and are a part of the system which drains the tip and the anterior two-thirds of the dorsum of the tongue.

The *submaxillary group* is found principally in the digastric triangle in more or less intimate relation with the submaxillary salivary gland. The glands of this group are adherent to the capsule, or lie between its folds, and lymph-tissue is even said to exist inside the capsule of the salivary gland itself. Glands continuous with these, and forming part of this group, extend as far back as the parotid. The submaxillary group receives afferent vessels from the border of the tongue as far back as the fauces, from the middle section of the anterior half of the tongue, the under surface of the tip of the tongue and the floor of the mouth. Associated with this group is a small chain of glands in the neighborhood of the hyoid bone.

The *superior deep cervical group* is composed of glands lying on the sheath of the internal jugular vein and on the carotid artery. The largest and most important gland lies at the point of division of the common carotid, or somewhat higher, and receives a large number of afferent vessels coming from the mouth and tongue. This group of glands extends upwards as high as the base of the skull, and drains all parts of the mouth, tongue and fauces and the upper part of the pharynx. Anastomosing with this group is a small cluster of glands beneath the lower end of the parotid salivary gland, receiving vessels from the anterior surface of the palate, which has a lymph drainage separate from that of the rest of the mouth and pharynx.

The *inferior deep cervical* or supraclavicular glands are those below the point of crossing of the omohyoid muscle and the internal jugular vein; they reach down behind the clavicle and receive some branches directly from the tongue, both from the apex and the base. The terminal branches of this chain on the left side at least, empty directly into the jugular

and subclavian veins independent of the thoracic duct. This chain also drains the floor of the mouth in its anterior part. Both of the deep cervical groups are more or less covered by the sternomastoid muscle, and are adherent to the deep layers of its sheath.

From a study of the lymphatic systems of the mouth and neck, we have brought home to us very clearly certain anatomical explanations of clinical symptoms bearing upon the problem of surgical interference. The base of the tongue is, anatomically speaking, separate from the body of that organ. The lymphatic systems of these two areas are quite distinct; thus, it is clear that in a large number of cases of cancer of the anterior portion of the tongue, the part behind the papillæ circumvallatæ can be spared. Although it is claimed that a lymphatic injection mass can be forced into both halves of the tongue from a given point, it is still obvious that the communication is not a direct one. It is probable that the lymphatic anastomosis between the right and left halves of the tongue is not a free one, and although the stream, as in other forms of cancer, may readily be diverted from its direct course by inflammatory or cancerous blocking of the lymphatic trunks, yet in early cases we may well expect that cancer should be limited to one side of the median raphé. If this were not the case it would be difficult, indeed, to explain in so many cases the radical cure of early cancer of the tongue by removal of that half of the tongue containing the disease.

The lymphatic drainage of the floor of the mouth involves even wider areas than that of the tongue itself. All of the muscles in this region are studded with lymph-glands, and the salivary glands from the sublingual in front to the parotid behind, have lymphatic glands in intimate relation with them, if not actually included within their capsules. All of these lymphatics may be regarded as way-stations on the main line leading to the deep cervical glands of the superior or inferior group. The direct lymphatic communication between the anterior portion of the floor of the mouth and the deep cervical

glands of the inferior group, must always be borne in mind.[2] Cancer of the tongue appears to involve the upper deep cervical glands primarily, whereas cancer of the floor of the mouth first attacks the submaxillary group (Wölfler). Cancer at the tip of the tongue, or of the floor of the mouth, near the frenum, passes first to the submental and sublingual group. According to Butlin, the lymphatic glands may be involved within a few weeks of the origin of the primary disease, but, on the other hand, several months may elapse before glandular involvement occurs.[3]

ETIOLOGY.

When all is said, little is known with regard to the etiology of cancer of the tongue and mucous membranes of the mouth. In this region more than most others, chronic irritation appears to be a contributing if not an exciting cause, and a number of different inflammatory conditions have been cited by different authorities as predisposing, or precancerous, conditions. Leucoplakia, or leucoma, is a chronic disease which may remain for years unchanged. In many cases, however, a tendency develops to induration, and even ulceration. There is first an hypertrophy, and then an ingrowth into the parts below.[4] Chronic ulcers, cracks and fissures, with or without hypertrophy of the mucous membrane, the direct result of the mechanical irritation of the teeth (dental ulcer), undoubtedly

[2] The reporter recalls in this connection a case of cancer of the lip with involvement of the submental glands, which was followed shortly by involvement of the supraclavicular glands without intervening disease. Among the hospital cases, also, there was one of carcinoma of the upper jaw, inoperable, in which a cancerous gland was removed from the axilla.

[3] There were 7 cases of cure of cancer of the tongue in the Massachusetts General Hospital series, in which no neck dissection whatever was done. The duration of the tumor in these cases was from 2 to 24 months.

[4] In 159 cases of cancer of the tongue quoted by Von Bergmann, leucoplakia was seen in 34.6 per cent. But, according to Butlin, in the greater number of cases, leucoplakia is not followed by cancerous degeneration.

favor malignant growth. Inflammation of the gum due to chronic pyorrhœa, with constant discharge of pus from around dead roots and carious teeth, may give rise to thickening and breaking down of the epithelium, and the development of cancer of the mucous membrane of the alveolar process. Epithelioma may also arise from the periodontal membrane. Persistent glossitis may give rise to more or less permanent structural changes in the tongue and long-continued ulceration, which must always be regarded with suspicion.

The opinion is wide-spread that both syphilis and smoking are important etiological factors in cancer of the mouth. Thus, Poirier would call cancer of the tongue, "cancer des fumeurs syphilitiques," and cites in corroboration of this opinion 32 cases of cancer of the tongue, all of which were smokers, and 27 of which had syphilis. Fournier also attributes to syphilis an important rôle in the etiology of cancer of the tongue and mouth. In 100 cases of syphilis, he describes 14 cases of leucoplakia, and in 184 cases of buccal cancer, 155 had syphilis. On the other hand, Whitehead's figures do not seem to point in this direction, for of 104 cases cited by him a definite history of syphilis was obtained in only 7; 62 of these cases, however, were smokers, and in the majority of cases the cancer was on the side of the tongue which came in contact with the pipe. In our own series of cases, and in those of Meller, tobacco and syphilis appear to be of slight importance. Most of us will probably agree with Butlin that syphilis is an indirect rather than a direct cause, as tending to produce those conditions of the tongue which predispose to cancer.

Owing to its appalling danger, there are few diseases in which an early diagnosis is more essential than in cancer of the mouth. There is no question but that the public should be better instructed in the hygiene of the mouth and teeth, and taught the importance of seeking medical advice for any chronic lesion of this portion of the body. "The practitioner of dentistry cannot be too conscious of the power he possesses of preventing death from cancer, and of the awful responsibility he incurs for overlooking precancerous conditions, or

early malignant disease of the mouth (Roughton)." Butlin calls attention to the fatal tendency of the physician to treat early cancer as syphilis, or as some other less serious affection of the mouth: "To give the patient 'a chance' is, under such circumstances, to give the carcinoma a chance to form an irresistible hold, and to take away all hope of complete recovery from the patient."

PATHOLOGY.

From the point of view of origin, there are two types of carcinoma of the mucous membranes of the mouth. The first arises from the epidermic layer of the mucous membrane, and the second from the epithelial glands immediately beneath its surface. Squamous-cell carcinoma, or epithelioma of the mucous membrane itself, is the prevailing type. In 80 cases of cancer of the tongue at the Middlesex Hospital, 76 were of this variety. It does not appear that cancer in other regions of the mouth differs materially from that seen in the tongue. A case of so-called "Paget's disease" of the jaw has been reported by Smith, which doubtless represents an early stage of epithelioma. Of squamous-cell carcinoma, two varieties are recognized,—basocellular and planocellular (spirocellular), or, as the French term them, "épithéliome tubulé" and "épithéliome lobulé," the former containing cells resembling those of the rete mucosum, and the latter containing the coarser type of squamous cells, with cell nests. Poirier in 20 cases found 9 épithéliomes lobulés, 2 épithéliomes tubulés, and 9 cases of the two varieties combined.

The situation and relative frequency of cancer in the different portions of the buccal mucous membrane may be appreciated by a consideration of the statistics of the Massachusetts General Hospital; 172 cases of cancer of the mouth showed the following distribution: There were 98 cases of cancer of the tongue and floor of the mouth; 40 of cancer of the mucous membrane involving the lower jaw, 14 of the mucous membrane involving the upper jaw, 11 of the tonsil and soft palate, and 9 cases of the mucous membrane of the

cheek. This relative frequency of cancer in these regions conforms closely to that of the 207 cases reported by Meller, and those of Boyd and Unwin, Morestin, Gurlt, and other writers.

It is a well-established fact that malignant disease of the mouth spreads both by direct contiguity, and by extension to lymphatic glands. In no other region of the body does growth by contiguity assume a greater importance, and in the majority of cases recurrence appears to be due to the failure of the surgeon to leave a sufficient margin of healthy tissue in the removal of the primary disease. It has been stated that many of the glands removed at operation though palpably enlarged, did not show cancerous involvement on microscopic examination (Jacobson, 15 per cent.). It would be rash, however, to act on the assumption that they were not involved to a certain extent, and that the microscopic examination had not failed to detect a few of the implanted cancer-cells.

There has been much discussion as to whether the lymphatic vessels leading from the primary growth to the nearest lymphatic glands were not possible sources of recurrence in cases in which the two-stage operation is performed. It has been held by some that epithelioma of the tongue, unlike cancer of other organs,—such as the breast,—extends not by continuous growth in the lymphatics (Handley), but by lymphatic emboli, and some of the advocates of the two-stage operation support this view. The success of the two-stage operation in many cases would appear to justify this belief, but it cannot be said to have obtained general credence. Boyd and Unwin are emphatic in stating that recurrence may occur from the failure to remove cancerous lymphatic vessels, and the advocates of the Kocher, Langenbeck, Crile, and other more radical operations, base their plan of operative treatment upon the belief that the whole lymph-bearing tissue,—vessels as well as glands,—should be removed in cancer of this region just as in any other portion of the body.

Internal, or remote, metastases are apparently most unusual. In 147 autopsies performed at the Middlesex Hospital

on cases of cancer of the tongue, the occurrence of internal metastasis was as follows: liver, 8; lungs, 7; pleura, 4; suprarenal, 3; heart, 2; and other regions, 1. Crile found in a study of 4500 cases of cancer of the head and neck that internal metastasis occurred in less than 1 per cent. We may safely conclude, therefore, that it is the local disease and the regional lymphatic metastasis which is the serious consideration of a surgical attack upon cancer of the mouth and tongue.

### DIAGNOSIS.

Enough has been said about the so-called precancerous conditions of the tongue and buccal mucous membranes to indicate the importance of early diagnosis. The symptoms actually pathognomonic of cancer develop only at a stage of the disease when operative interference can promise little, if any, hope of radical cure. A large indurated ulcer extending from the side of the tongue across the floor of the mouth to the alveolar process and accompanied by enlarged lymph-glands of the submaxillary or deep cervical group permits of little doubt as to diagnosis, and still less as to the ultimate result. It is the early and doubtful cases that require especially the surgeon's consideration.

The indiscriminate use of specific treatment as a means of diagnosis should be thoroughly discouraged. The therapeutic test is often fallacious, according to Hutchinson. Iodide of potassium often improves an epithelioma and relieves pain, and hygiene of the mouth, with careful feeding, often helps to improve local conditions. Antisyphilitic treatment should certainly not be continued for a sufficient length of time to allow any perceptible increase of the growth.

In the very early and doubtful cases, an exploratory operation is the safest and most scientific solution of the problem of diagnosis. This should not be attempted, however, until all the preparations have been made for performing the complete operation if it prove to be required. For such an exploratory operation, if possible, the whole of the primary growth should be excised, in preference to the removal of a small

portion. This tissue can be submitted to a pathologist, who should always be present at an operation of this character. A "frozen section" can then be made and a positive diagnosis returned immediately. The more material given the pathologist, the more accurate his diagnosis, and the less likelihood of spreading the disease by setting free living cancer-cells in the depths of the wound. Removal of the surface of the growth by curetting can hardly be considered a sufficiently exact method for general use, and the results of punching out specimens for examination may lead to cancer extending along the exploratory tract, as was shown by Richardson in a case of cancer of the breast. The disturbance of a primary lesion any considerable length of time before an operation is to be avoided if possible, and it is for this reason better to defer the exploration until the patient has been anæsthetized and prepared to undergo the radical operation, if it should be required.

### OPERATIVE TREATMENT.

Operations for the radical cure of cancer of the tongue and mucous membranes of the mouth have been developed by different surgeons along several different lines. We readily distinguish three main classes of operations for the removal of the primary tumor: (1) the intrabuccal operation, (2) the approach beneath the jaw, and (3) operations involving the division or resection of the lower jaw. For the removal of the lymphatic glands beneath the jaw and in the neck, a variety of operations are described, differing chiefly in the extent of the operative attack, and in the thoroughness with which the lymph-glands are removed. Surgeons differ also with regard to the preliminary treatment of their patients and the technical details of the conduct of the operation.

*Preliminary Treatment.*—The reporter has long believed that a proper cleansing of the mouth by a dentist, with the removal or treatment of carious teeth, should precede any operation in the mouth. It is not to be expected that the buccal cavity can be made an aseptic field of operation, but the number and variety of pathogenic bacteria which normally inhabit it,

can surely be diminished. The hypodermic injection of atropine, $^1/_{100}$ grain, one-half to one hour before operation, is of decided benefit in reducing the flow of mucus and promoting a quiet anæsthesia. The hypodermic injection of morphia, ¼ to $^1/_6$ grain, before operation, is also practised by many surgeons with the same purpose in view.

*Anæsthesia.*—Ether is the anæsthetic most commonly employed for operations upon the tongue and mouth, although chloroform is used by a number of surgeons (Morestin, Eisendrath, Küster). In the Massachusetts General Hospital cases, ether has been used exclusively.

The position of the patient is influenced somewhat by the anæsthetic employed, and by the different methods of preventing the access of blood to the respiratory tract. The upright position in an operating chair, as used by some surgeons at the Massachusetts General Hospital, or in a rocking-chair, as advocated by Whitehead, offers certain advantages. In this position, the blood escapes freely from the mouth, but anæsthesia cannot be carried to its full extent, and coughing, and even vomiting, sometimes hamper the surgeon and perhaps may infect the wound. The lateral position, as recommended by Butlin, allows the blood to escape from the mouth freely, but does not offer the surgeon an unrestricted operating field. It is doubtful whether this position could be used except with the preliminary laryngotomy employed by Butlin. Poirier and other surgeons advise Rose's position for the intrabuccal operation, while Crile and a number of American surgeons have employed the semi-upright position, combined with bandaging of the extremities and intubation of the pharynx.

Some surgeons insist strongly upon the importance of ligature in the neck, by a preliminary incision, of the lingual or external carotid arteries in order to diminish hemorrhage, while others (Whitehead) consider this detail unnecessary. Crile advocates the use of temporary clamps upon the common or external carotids, on one or on both sides, and claims to obtain a practically bloodless field by this manœuvre. He states that he has clamped the carotid in 61 cases, without

either immediate or remote complications. His method of diminishing venous hemorrhage is by the partially upright position.

There has been much discussion upon the propriety of performing the intrabuccal and the neck operations in two stages. The mortality of the combined operation as stated by Butlin in 13 cases, was 23 per cent. as opposed to a 7 per cent. mortality when the operation was done in two stages. Associated with this question is the discussion of whether the lymphatic vessels are the site of continuous cancer growth, as held by some, or whether embolic infection of the lymph-glands occurs without intervening disease of the lymphatics. Butlin, Crile, Whitehead and Jacobson advocate especially the two-stage operation, while Kocher, Von Bergmann, Poirier, Kuttner and Eisendrath perform the local operation and the neck dissection at one sitting. The two-stage operation is designed to diminish shock and sepsis, and to lower the rate of mortality. It entails, however, an added nervous strain, and is an ordeal many patients might be unwilling to undergo. Its weakest point, however, is that it fails to remove the zone of lymph-bearing tissue behind the jaw. It may be that the two-stage operation represents only a stage in the development of the operative surgery of cancer of the tongue, and that with greater resources and improved technic the mortality of the operation may be in time reduced, so that the whole radical operation can be safely performed at one sitting, and the disadvantages and dangers of delay avoided.

The protection of the air-passages in operations about the mouth presents many difficulties. The upright position of the patient may give sufficient protection without other aid, but that this is not invariable is shown by the other expedients which have been devised. Butlin performs a preliminary laryngotomy and lays stress upon its advantage in favor of the prognosis of the operation. The tube is withdrawn as soon as the operation is complete, the wound heals promptly, and leaves an almost imperceptible scar. Jacobson also recommends laryngotomy, while the continental surgeons more commonly

employ tracheotomy. Both of these procedures are supplemented by packing the pharynx with gauze above the tube to prevent leakage into the air-passages from above. Crile has devised a method of intubation of the pharynx which appears to be satisfactory in the majority of cases, and has been widely adopted in America. Two rubber tubes as large as can be drawn through the nares, are pushed down to the epiglottis, the tongue is drawn well forward, and gauze packing is introduced about the tubes into the pharynx, which should be previously cocainized. These tubes are connected by a Y tube with a glass funnel, and ether is administered by the drop method on a piece of gauze placed over the top of the funnel.

To summarize these details of operative technic, it may be said that the upright or semi-upright position with intubation of the pharynx or tracheotomy are the methods most commonly employed for either intrabuccal or more radical operations; that the use of a clamp on the common carotid, or ligature of the external carotid is a wise precaution in undertaking the more extensive operations, and that the operation in two stages, allowing an interval of ten days to two weeks before the neck dissection, although open to certain criticisms is the most popular procedure.

### VARIETIES OF OPERATION.

TONGUE AND FLOOR OF MOUTH.—The operations upon the tongue and floor of the mouth have been roughly divided into three groups: (*a*) intrabuccal operation, (*b*) removal below the jaw, and (*c*) removal by division of the jaw.

*Intrabuccal Operations.*—The typical intrabuccal operation is that described and practised so well by Whitehead. It was designed before the dissection of the various groups of lymphatic glands was introduced as a routine method, and is done entirely independent of the neck operation, which may or may not be performed immediately or at a subsequent period. The upright position of the patient is essential. A ligature is passed through the tip of the tongue, which is drawn forward, and upward to its fullest extent. The frenum

and the mucous membrane on one side of the tongue as far back as the anterior pillar of the fauces, are divided. When the whole tongue is to be excised, the same is done on the other side. If one-half of the tongue only is to be removed, an incision is made along the dorsum on the median line, and the tongue split back along its raphé. The surgeon now draws the diseased half upward and forward to make the geniohyoglossus muscle tense, and divides it close to its point of origin. The tongue can now be drawn out, so that the remainder of the operation is almost extra-oral. Whitehead operates upon the glands of the neck at a second operation at a later date, when he has reason to consider them to be malignant, but it is clear from the various descriptions of his operations, that there are many cases in which the intrabuccal operation is performed alone.

Butlin performs an intrabuccal operation which does not differ essentially from that of Whitehead, although he places his patient in the lateral position and performs a preliminary laryngotomy. Butlin, however, lays great stress upon the dissection of the neck, which he performs as a secondary operation. He aims to remove all of the lymphatic glands and the lymph-bearing tissue of the inferior and superior deep cervical, the submaxillary and the sublingual groups. The muscles and the great vessels are cleaned of fascia and fat, the submaxillary salivary glands are removed entire, and the submental region thoroughly dissected. Where the disease is near the median line, both sides of the neck are dissected.

Poirier performs an operation similar to that of Butlin, although the intrabuccal operation and the neck dissection are done at one sitting; the two wounds, however, do not communicate.

Crile's "block dissection" of the neck deserves special mention, as having been worked out on a physiological and pathological basis. Crile has proved that the structures of the neck can be safely sacrificed in the extirpation of cancer to an extent that has not been before believed. The removal of the sternomastoid muscle causes little inconvenience; the omo-

hyoid, the digastric, the sternothyroid and sternohyoid and the platysma are of minor importance. Unilateral excision of the vagus is attended by hoarseness of the voice, but this is of very little consequence. Unilateral excision of the phrenic is followed by less than half paralysis of the diaphragm. Unilateral excision of the hypoglossal nerve affects the tongue somewhat in speech, but a fair degree of compensation is acquired. Bilateral excision is usually fatal from pneumonia. Removal of one or even both internal jugulars is of little consequence, but a compensating route for collateral circulation must be assured before the second jugular is tied. Thus, all of the structures of one side of the neck, with the exception of the common carotid artery, may be sacrificed if necessary. Crile has elaborated the technic of this operation to permit the removal of these tissues in a block dissection. With the semi-upright position, safeguarded by the pneumatic suit, intubation of the pharynx and temporary closure of the common carotid, this extensive dissection can safely be performed. In cases of cancer of the tongue and floor of the mouth, Crile performs an intrabuccal excision similar to Whitehead, and follows this, after a period of about two weeks, with a block dissection of the neck, going up to, but not into the buccal wound. He lays stress also upon the reduction in the number and intensity of surgical contacts, such as forcible retraction, vigorous and repeated sponging, and blunt dissection. Hemorrhage, mismanaged anæsthesia and duration of operation are also important factors in the production of shock. Crile also follows up his operation upon the neck by X-ray exposure of the open wound during the period of convalescence.

Among the 62 cases of cancer of the tongue and the floor of the mouth which were operated upon at the Massachusetts General Hospital, 20 intrabuccal excisions of the tongue were performed, and the end results are known in 19 of these cases. In 7 cases, the neck dissection was performed, while in 13 no operation upon the neck was done. Of all the 20 cases 8 are now alive and well, or have died without recurrence over

3 years from the time of operation, giving 40 per cent. of cures, a much higher ratio of successful cases than has been obtained by other methods of more radical operation; 7 of the 8 cures resulted from intrabuccal excision of the growth without the dissection of the neck. The operative mortality of the 20 intrabuccal operations was 1 case, 5 per cent., death in this instance being due to general sepsis. To compare with these figures, we have the report by Whitehead of 139 operations for cancer of the tongue, 101 of which were for cancer restricted to the tongue itself, with a mortality of only 3 per cent. So far as the Massachusetts General Hospital cases are concerned, it would appear that the early and more favorable cases were the ones chosen for the intrabuccal operation. All of these successful cases are substantiated by microscopic examination of the specimens, and it is hard to believe that cures would have resulted had the excision not been performed before the glands of the neck had become involved.

*Operations Below the Jaw.*—Although many modifications of this operation have been devised by different surgeons, the fundamental principles may be attributed to the early description of this operation by Kocher. An angular incision is carried from the chin to the ear, reaching downward as far as the hyoid bone. The submaxillary group of glands are dissected free, and the mouth is entered below the jaw by division of the mylohyoid. The diseased portion of the tongue and floor of the mouth is removed below the jaw, and the dissection of the neck and removal of lymphatics and other cancerous tissues is carried to such an extent as may seem to be required. This is the operation which commonly goes by Kocher's name, although he later adopted a division of the lower jaw after the method of Syme.

Regnoli's operation, one of the oldest from an historical point of view, makes use of the same principles as Kocher's, and removes the tongue through the middle of the floor of the mouth beneath the chin. It can be applied to cases of cancer near the tip of the tongue, and at the frenum, but should be supplemented according to modern views, by dissection of the

neck. In cancer of the floor of the mouth, on one side only, in this region, the submental incision may be limited to one side and the operation made partly buccal and partly cervical, as the reporter has done with success on several occasions. Küttner performs the Kocher operation, and recommends a "luxurious" extirpation of the primary growth. Eisendrath performs a similar operation, as do Kammerer and Willy Meyer. Boyd and Unwin consider that removal of the tongue beneath the jaw invites cancerous infection of the neck, and increases the danger of recurrence. The two-stage operation cannot well be performed by this method, and for that reason alone the operative mortality must probably be higher than with intrabuccal operations. In the Massachusetts General Hospital series, Kocher's excision below the jaw was performed in 29 cases, with an operative mortality of 3, or 10.3 per cent., death being due in each case to sepsis and bronchopneumonia. There were 2 cures among the 29 cases, or 6.9 per cent. To contrast with these figures, we have Kocher's own cases as reported by Sachs; 58 operations, 12 of which were by excision beneath the jaw, with an operative mortality of 8.3 per cent. Meller reports 2 cases only by this method of operation, both of which survived. Butlin estimates the mortality of this operation in 62 collected cases as 20 per cent. There can be little question that the operative risk is much increased over that of the intrabuccal operation; as far as cure is concerned, the cases submitted to this operation at the Massachusetts General Hospital cannot fairly be compared with the earlier and more favorable cases in which the intrabuccal operation was performed.

*Excision by Division or Resection of the Jaw.*—Langenbeck's method, as modified by Von Bergmann, is the one generally referred to in literature when it is intended to reach the disease through the lower jaw by dividing the bone. An incision is made from the angle of the mouth through the cheek to the masseter muscle, and continued downward through the submaxillary and hyoid regions. The lingual artery is tied and the lymphatic and salivary glands are dissected and

left hanging to the floor of the mouth. The lower jaw is then divided obliquely with a Gigli saw, the fragments are separated and the disease removed as on the surface of the body. Von Bergmann sutures the remaining mucous membrane in such a way as to establish a fistula to drain the region of the epiglottis and base of tongue. The bone is wired. This operation is one adapted as well to the removal of malignant disease of the floor of the mouth, tonsil, soft palate or pharynx, as of the tongue. It is necessarily employed in connection with excision of a portion of the jaw, when the jaw itself is involved in the disease.

The operations of Sedillot or Syme, which aim to expose disease of the tongue and floor of the mouth by a median incision, and division of the jaw at the symphysis, belong in the same class. Operations of this character are designed especially for advanced cases of carcinoma, and give a high mortality. In the Massachusetts General Hospital series there were 13 operations for cancer of the tongue and floor, in which the jaw was divided or excised, and 4 of these cases died soon after operation, a mortality of 30.7 per cent., which may well be contrasted with the 10 per cent. mortality of the Kocher operation, or the 5 per cent. of the operations of the Whitehead type. In the Massachusetts General Hospital series also, there were no cures in any of these 13 cases, although in 2 of the number a final report could not be obtained. The causes of death were: sepsis in 1 case, and pneumonia with or without sepsis in 3. Sachs gives the operative mortality of jaw resections as 19 per cent. Butlin gives the mortality for 47 operations as 25 per cent. Meller reports 7 cases of cancer of the tongue in which jaw section, or resection was done, and of these 3 died soon after operation, or 42.8 per cent. It would be futile to deny that section or resection of the jaw adds enormously to the gravity of the operation, and it is only to be regretted that many patients present themselves with their disease so far advanced that one of these grave operations must be performed, if anything at all is to be done to ward off the otherwise inevitable death. It is true that in none of the

Massachusetts General Hospital cases was this desired result obtained, but the attempt at least was made, and in the long run life was prolonged. When we realize the immense advantages of the free approach to the disease which is given by division of the jaw, it becomes a question whether, with a proper technic, this should not be adopted more frequently (and in early cases) instead of being placed among the discarded features of the operation.

A good deal is said about anatomical relations, in connection with these operations, but it must not be forgotten that in the words of a distinguished surgical teacher: "Anatomical considerations must be made subservient to the one grand purpose of the operation,—eradication of the disease."

Operations for the cure of cancer in this region are distinctly less far advanced than those for cancer of other portions of the body. The mechanical difficulties to be overcome are greater; the lower jaw offers a barrier to the free sweep of the knife. The presence of important nerves and vessels in the neighborhood, and the severity of the operative attack, add greatly to the dangers of the operation itself, while the close relations of the air-passages and of the buccal tract make the problem of a safe and speedy convalescence much more difficult. It is not to be wondered at that a large number of cases have hitherto been regarded as bad surgical risks, and that many are turned away as inoperable cases when they first present themselves at the clinic. Of 172 cases of cancer of the tongue and mouth at the Massachusetts General Hospital, 50, or 29 per cent., were already inoperable, and 10 others refused any operation.

Modern research has given a distinct impulse to surgery of the mouth. Discussion turns no longer on primary ligature of the lingual artery, but upon the distribution of the cervical lymphatic glands. All writers dwell upon the danger of handling the diseased tissue, and of bringing softened gland-substance or the secretion of ulcerated surfaces in contact with the wound, and some go so far as to irrigate the open

wound with antiseptics to prevent the artificial propagation of the disease.

The extent of operation upon the tongue itself is a question upon which authorities do not agree. In cancer of the breast, or of the uterus, there is of course no question but that the whole of the organ is to be removed. The conditions in the tongue, however, are peculiar. Almost completely separated into two symmetrical parts by the median raphé, it has many of the characteristics of a double organ. There are two sets of blood-vessels, two sets of nerves, and a double set of lymphatics. Each of these systems, though anastomosing across the middle line, is anatomically distinct. To this is added the clinical experience so often noted,—that cancer remains restricted to one side, and does not readily cross the raphé. This barrier, however, is an imperfect one, and in advanced disease reliance cannot be placed upon it. In early cases, however, the healthy half of the tongue can frequently be saved. It is also worthy of note that cancer does not spread toward the tip of the tongue, but rather toward the base. For this reason, the tip can often be saved and the edges stitched together, or folded on itself to form the so-called "parrot-tongue"; a measure which aids in closing the wound and helps to improve the speech. Especially is it to be remembered that the capillary lymphatics of the base, and those of the body of the tongue, are developmentally and anatomically quite distinct, for in the majority of cases this gives the surgeon the opportunity to leave enough of the base of the tongue to form a serviceable stump.

Of 98 cases of cancer of the tongue and floor of the mouth at the Massachusetts General Hospital, 62 were operated upon, but in 5 cases the end result could not be determined. From the remaining 57 operations, 10 cures resulted; 9 of these cases were alive and well at the following periods after operation: $3^{1}/_{3}$, $3^{7}/_{12}$, $4^{1}/_{6}$, $6^{8}/_{12}$, $7^{6}/_{12}$, $11^{8}/_{12}$, $12^{4}/_{12}$ and 13 years, and 1 died of heart disease 6 years after without recurrence. One of the 10 had a local recurrence (or a new attack of the disease) 8 years after the first operation, but this was removed

and the patient has now been well for 5 years. The percentage of cures in these cases is thus 17.5 per cent., or if (following the example of Meller) only the total of operated cases is considered, 10 in 62, or 16 per cent. Carrying the time limit on to 5 years after operation, all of the cases operated upon in 1902 and 1903 are thrown out, leaving 45 cases with 7 cures, or 15.5 per cent. Comparison with other statistics is difficult, because of the varying requirements established by different writers. The Massachusetts General Hospital cases are taken consecutively from the record books. All of the cured cases are supported by microscopic examination of the specimens, and no case is included which has not survived a period of at least 3 years since operation. The best results claimed by any surgeon are those of Riedel (of Jena),—24 operations with 8 cures, or $33^1/_3$ per cent. (Jahr). Butlin gives 24.7 per cent. as his latest percentage of cures. From these figures the percentages run down, depending largely upon the rigidity with which the statistics are scrutinized, to much smaller figures. It is probable that 17 per cent. comes close to the average expectation of cure in any of our general hospitals.

The operative mortality of operations for cancer of the tongue and mouth depends largely upon the nature of the operation performed, and has been already discussed. Of the whole number of 62 operations, 8, or 12.9 per cent., resulted fatally.

When the disease was confined to the tongue or floor of the mouth, at its point of origin, as in 29 cases, cure was obtained in 31 per cent. When other structures were involved, the percentage of cures was only 3.4 per cent.

Recurrence of the disease took place in 40 of the 57 patients operated on, in whom the result is known. In only 2 cases did a patient with recurrence live over 3 years after operation.

In 13 local recurrence alone occurred. In 14 both local and glandular return of the disease, and in 8 the recurrence was in the lymphatic glands alone. Even in cases of recurrence life was prolonged by operation.

LOWER JAW.

Operations for cancer of the mucous membranes of the alveolar process of the lower jaw, and involving the bone, permit of little difference in extent, although the technical details of preparation, position of patient, anæsthesia, the use of clamps, and the protection of the air-passages, may be varied as in the case of operations upon the tongue. Any radical operation involves the excision of a part, or the resection of the whole of one or both halves of the inferior maxilla. There were 40 cases of cancer of the mouth involving the lower jaw in the Massachusetts General Hospital series, 28 of which were submitted to operation; 10 patients died as a result of the operation (35.7 per cent.),—a large mortality,—and there were 5 cures (17.7 per cent.), or, of the traced cases, 19.2 per cent. Taking 5 years as the limit for a cure, 22 cases are available with 3 cures, or 13.6 per cent. There were no cases of recurrence over 3 years after the operation.

The operations performed upon these 40 cases were as follows:

| | | | | |
|---|---|---|---|---|
| Resection alone, 12 | 1 | cure, | 5 | operative deaths. |
| Resection + neck dissection, 4 | 1 | " | 2 | " |
| Resection + neck + other parts, 3 | 1 | " | 1 | " |
| Minor operations, 7 | 2 | " | 2 | " |

It is thus apparent that any operation upon the lower jaw for cancer is attended by considerable risk. The causes of the 10 operative deaths were:

| | |
|---|---|
| Shock and hemorrhage | 3 |
| Sepsis | 1 |
| Sepsis and pneumonia | 2 |
| Secondary hemorrhage | 1 |
| Debility, heart lesions, etc. | 3 |

Bryant gives the mortality for resections of the lower jaw as 20 per cent., and from Meller's case-reports, 36 cases of cancer involving the lower jaw and requiring resection or excision, have been tabulated with results as follows: 36 cases,—7 cures (19.4 per cent.) and 6 operative deaths (16.6

per cent.). These are the only figures available for direct comparison, but they show a notably lower operative mortality, although the cures are practically the same. Because of the high mortality, the neck dissection might perhaps better be postponed for a later operation.

### UPPER JAW.

Operations for cancer of the mucous membranes covering the alveolar process of the upper jaw and the hard palate, like those involving the lower jaw, admit of little variety except in the extent of the operative attack. There were 14 such cases in the Massachusetts General Hospital series, with 10 operations and no cures. Meller gives the histories of 12 such cases with 1 cure, and Boyd and Unwin 1 case, with recurrence. There were no operative deaths in the Massachusetts General Hospital series, confirming the general belief that operative attack upon the upper jaw is less dangerous than that upon the lower jaw. There were 5 total resections, 1 partial excision, and 4 minor operations, but in no case was the dissection of the neck attempted. This, however, was not the only reason for the lack of success, for 8 of the 10 cases at least showed local recurrence, and it is evident that the primary tumor was not completely extirpated. It is interesting to note that in one of the inoperable cases of this character enlarged axillary glands were removed and found to be involved with epithelioma.

### TONSIL AND PALATE.

The region of the tonsil and pharynx may be approached by several different routes for the extirpation of malignant disease. "Trans-hyoid pharyngotomy," as performed by Carless, gives access especially to the base of the tongue and epiglottis. For this purpose a median incision is made from the chin to the thyroid cartilage, bisecting the hyoid bone. The edges of this wound are retracted, and the pharynx entered between the top of the epiglottis and the false cords. Tracheotomy is a necessary adjunct. Cheever enters the

pharynx through a cervical incision following the line of the angle of the lower jaw, dividing the stylohyoid and styloglossus muscles, and separating the fibres of the superior constrictor.

Mikulicz's operation involves a division of the angle of the lower jaw, and dislocation and resection of the ascending ramus. It is comparable to the operation upon the tongue of Langenbeck, and to the resections of the lower jaw, and should give a similar high mortality. Boyd and Unwin report 4 cases of cancer of the fauces, on which they performed an operation of a similar nature to Mikulicz's, with the addition of the neck dissection. There were no operative deaths, but there were no cures.

The reporter finds a modification of Langenbeck's operation combined with a block dissection, the most effective method of reaching the region of the tonsil, palate and base of the tongue. The incision runs from the angle of the mouth vertically downwards to the lower edge of the jaw and along the lower border of the jaw as far as the lobe of the ear. The cheek is separated from the bone, and thrown back. The superficial fascia of the neck which is attached firmly to the lower edge of the horizontal portion of the jaw should be divided as far back as the angle of the jaw, the facial artery being clamped, cut and tied. A blunt dissector slipped into the incision liberates the floor of the mouth on that side from the inner aspect of the bone by a few brisk to and fro sweeps of the instrument. The soft parts drop towards the median line and the approach to the tongue and the mouth is greatly facilitated. The jaw is now divided in front of the masseter and the ramus thrown backward with the skin flap. An extension of the incision downward along the anterior border of the sternomastoid muscle uncovers the infected gland area. This operation exposes the mouth and pharynx so that any disease, however extensive, becomes easily accessible, and the surgeon is, as it were, operating on the surface of the body. The primary and secondary lesions can be removed "*en bloc*," and the operation completed in a comparatively short time and

without undue hemorrhage and shock. There need not be as much hemorrhage as in an operation for cancer of the breast. In less advanced cases with the same skin incision, and without dividing the bone, the neck having been dissected, the operation on the mouth becomes a simple matter, and the diseased portion of the tongue is removed together with the glands. The facial incision recommended gives far less deformity than the splitting of the cheek, and gives access to the mouth, bone and the upper part of anterior triangle.

Of 11 cases of cancer of the tonsil, fauces and soft palate in the Massachusetts General Hospital series, only 4 were considered suitable for operation. One case, an epithelioma of the soft palate, removed by excision through the mouth was cured ($7\,^{10}/_{12}$ years). Of the other cases, 1 was merely curetted, while 2 were given radical operation with dissection of the neck, and removal or division of the jaw. There were no operative deaths, but 2 of the 3 cases had a local return of the disease, and the other died of cancer, though the site of recurrence could not be determined. Of the 7 inoperable cases, all showed enlarged glands in the submaxillary region, or anterior triangle of the neck.

Meller records 16 cases of cancer of the tonsil or palate, with 1 cure (6.2 per cent.), and quotes the figures of Hensel (7 cases and no cures); Boyd and Unwin report 5 cases with no cures. It would appear that under existing conditions, only the earliest and most favorable cases can expect radical cure of the disease, and that the local excision should be more generous if cure is to be attempted for cancer in this portion of the mouth.

### CHEEK.

Standard operations for cancer of the mucous surfaces of the cheek are not yet in existence. Morestin suggests the following operation. Two long incisions starting from the labial commissure, or including a portion of each lip, and, including between them the diseased area, run as far as the anterior border of the sternomastoid muscle. Exposure and

dissection of the submaxillary triangle follows, with ligature of the facial artery, separation of the floor and of the mouth from the diseased mass; and liberation of the mass *en bloc* from its surroundings by deep dissection and by division of the jaw near the median line; division of the ascending ramus and removal of the growth. The mucous membrane of the floor of the mouth is stitched to that of the upper buccal fold. The large gap left is closed at a subsequent operation. Morestin advises light chloroform narcosis, and rapidity of operation. Although the hemorrhage is severe, but 1 of the 10 cases succumbed. He mentions 3 cases well at least two years after the operation out of a collection of 25 cases, some of which were inoperable. He emphasizes the importance of removing the part of the lower jaw which is involved in the disease. In 1 of his successful cases, an operation of this type was performed in the early stages of the disease.

Boyd and Unwin report 10 cases of operation for cancer of the cheek, involving the gums back to the coronoid process and including the sulcus of the cheek. They found intrabuccal operations unsatisfactory, nor was splitting the cheek wholly satisfactory. They advise dividing the lip and chin in the median line, and turning the cheek back. A portion of the bone may be removed, if involved, in one piece with the disease. Division of the jaw should be made or the ramus removed in whole or in part if the growth requires it. When there is danger of closure of the jaws from cicatricial contraction, a wedge of bone should be removed at the time of the operation to ensure permanent mobility of the jaw.

It would appear that Morestin and Boyd and Unwin include under cancer of the cheek, cases which we have classed under the upper and lower jaw. Boyd and Unwin, however, report 4 cures in 10 cases, 40 per cent., and Meller in his report details 8 cases of cancer of the cheek, of which 2 were cured; so that the results in the Massachusetts General Hospital series of 9 cases with 8 operations and no cures, appear to be less favorable than may reasonably be expected. The operative mortality of the Massachusetts General Hospital

cases, 2 deaths in 8 operations, or 25 per cent., is also higher than seems justified. These deaths were due to shock in 1 case, and delirium tremens in another. The 8 operations were, 3 of them of a local and palliative nature, and 5 were radical excisions, involving the jaw in 2 cases, and accompanied by dissection of the neck.

Five of the 8 operations, however, were followed by local return of the disease, and in 2 of this number there was glandular recurrence also.

### RÉSUMÉ OF OPERATIONS AND RESULTS.

The prospects of radical cure by operative attack upon cancer of the tongue and mucous membranes of the mouth appear to be inferior to those devised for the cure of cancer in other regions of the body. This is chiefly due to the anatomical and physiological conditions, which make extensive operations in this region extremely dangerous to life. It may truthfully be said that surgical attempts to remove cancer in this portion of the body, have too often been confined to excision of the primary growth and that in the majority of cases even this attempt has not been sufficiently radical, and a wide enough margin of sound tissue has not been removed to justify the procedure as an attempt at radical cure of the disease. Too often the lymphatic glands are entirely disregarded; of 112 operations upon cancer of the tongue and mouth in the Massachusetts General Hospital, in only 51, or 45.3 per cent., was any attempt made to dissect the cervical lymphatics. It is true that a certain number of these operations were undertaken only as palliative measures; but in 10 of the 16 cures simple excision of the primary growth was the only operation done. From this we may judge that it was only the earliest and most favorable cases in which a cure resulted, and the total of 16 cases, or 14.2 per cent., of all cases submitted to operation, is sufficient indication that more radical operation is required if greater success is to be obtained.

Local recurrence of the disease took place in 39, of the total number of 49 operation cases, of which we have accurate

record, while glandular recurrence is noted in only 20. Of the other cases specific details are lacking.

From these figures we may conclude that the local as well as the lymphatic portion of the operation was deficient in extent.

### PALLIATIVE TREATMENT.

Since the radical cure of cancer of the tongue and mouth fails in a certain, and at present considerable number of, cases, palliative treatment must be considered. It has long been claimed that the duration of life was greater after operation even when recurrence ultimately took place, than in unoperated cases. This appears to be true in our statistics. Leaving out of consideration the operative deaths (20) and the cures (16) in the whole number of 112 operations of the Massachusetts General Hospital series, the duration of life was notably longer in the cases which were admitted to operation, in every class.

| | Unsuccessful operation average. | Inoperable cases average. |
|---|---|---|
| Tongue | 12-1 months. | 7-0 months. |
| Lower jaw | 10-9 " | 5-4 " |
| Upper jaw | 14-5 " | 6-5 " |
| Tonsil | 11-3 " | 6-4 " |
| Cheek | 8-6 " | 7-0 " |

The attempt at radical cure might thus be considered a palliative operation in the cases where radical cure is not obtained. So far as comfort is concerned, there are no statistics to support the opinion, but it is a wide-spread one, that the comfort of the patient is much enhanced by even a partial removal of the offensive ulcerating and necrotic tissue in the mouth.

Division of the lingual nerve to relieve pain is not performed as frequently as in former days. When done, a portion of the nerve should be excised. The Middlesex Hospital reports 9 cases (before 1870) in which this operation was done on one or both sides, with slight improvement in 3.

Ligature of the lingual arteries in inoperable cases is advised by many writers (Küster), and is claimed to diminish notably the rapidity of growth; I have no personal knowledge of the efficacy of this procedure.

Hygiene of the mouth and the insufflation of powders containing borax, iodoform or morphine, and the use of cocaine in solution, and packing with iodoform gauze, have all been recommended as effective measures of relieving pain and fetor.

In some cases the Röntgen rays seem to have a restraining influence on the glandular growth, but the successful cases reported in literature are few and unconvincing. In two cases in which this treatment was tried by the reporter, the glands softened and an enormous ulcer formed, covering the neck from jaw to clavicle. Radiotherapy has, however, achieved a certain success in some of the milder forms of the disease. De Beurmann reports a case of leucoplakia followed by a tubular epithelioma which disappeared under treatment by Röntgen rays, but the case was too recent for a definite result. Others report favorable cases similar to this, but the general experience seems to be that in the more active form of epithelioma the lobulated or nest-cell containing type, temporary improvement is followed by a sudden exacerbation of the disease, and this latter type is, as we have seen, by far the most common form of epithelioma.

The action of *radium* on epithelioma of the mucous membranes has been well tested by Abbe. He has used this remedy in 8 inoperable cases of cancer of the tongue, and concludes that it is as distinctly beneficial at the start, as in epithelioma of the skin, but that in no advanced cases of the disease when it has invaded the muscle of the tongue has it yet been finally curative. In three cases of growths in every way resembling epithelioma, but occupying as yet only the superficial layers, a rapid and easy cure has followed.

He concludes that from our present experience we can expect a cure in the early stage of cancer only, but that further study may reveal that a more correct estimate of the amount

of the dosage of radium application or some improved method of using it will give finer results, even in advanced cases.

The conclusions which we may derive from a review of the literature and an analysis of these statistics of cancer of the mouth and tongue are as follows:

1. The relation of the lymphatic system to the primary growth is the most important anatomical consideration in operations for cancer of the mouth and tongue.

2. Chronic inflammatory processes of the mucous membrane which do not yield promptly to local treatment, are of importance as predisposing or precancerous conditions, and should be treated surgically.

3. Cancer of the mouth and tongue is a local disease limited to the tissues immediately surrounding its point of origin, and to the adjacent lymphatic system. Internal metastases are rare.

4. Microscopical examination of the primary growth should be made the crucial test of diagnosis in doubtful cases, and should be done preferably at the time of the operation. Antisyphilitic treatment is not a sure guide, and should not cause delay in surgical interference.

5. The modern operative treatment of cancer of the mouth and tongue involves:

*a.* Preliminary treatment of the cavity of the mouth;

*b.* Protection of the respiratory tract by drugs, and by intubation of the pharynx, or laryngotomy, or by position;

*c.* Removal of the primary lesion with a margin of one inch, if possible, of healthy tissue;

*d.* Block dissection of the lymphatic bearing tissues of the anterior cervical triangle, on one or on both sides as a routine measure;

*e.* A lower operative mortality may be obtained by performing the block dissection of the neck as a secondary operation about two weeks after the excision of the primary disease;

*f.* The intrabuccal operation is inadequate to reach the entire operation field, and should be supplemented by a dissection of one or both anterior cervical triangles;

*g.* The submaxillary route, although it permits a block dissection, does not give as free access to the diseased tissues as is demanded in an operation for cancer;

*h.* The route through the jaw exposes the whole field of operation, and enables the surgeon to act as if operating upon the surface of the body, but division of the lower jaw as at present performed adds greatly to the surgical risk.

6. The ideal operation of the future should contemplate a free exposure of the mouth and anterior cervical triangles as one continuous area, with a block dissection of its diseased contents. The use of mechanical devices for protection of the respiratory tract, and the perfection of technical details of the operation, along the lines already suggested, should enable us to perform an operation of this character without incurring the large mortality which is now to be expected.

7. The mortality varies with the extent of the operation, and is lowest (5 per cent.) with the intrabuccal operation, and highest (30–35 per cent.) in the operations involving division or resection of the lower jaw. Death is, as a rule, attributable to shock, sepsis or bronchopneumonia.

8. In a series of cases taken consecutively from the records of the Massachusetts General Hospital, 112 operations upon cancer of the tongue and mouth, resulted in 16 cases free from recurrence over 3 years after operation (14.2 per cent.) (all supported by pathological examination of the tissue).

9. Of 57 cases of cancer of the tongue, 10, or 17.5 per cent., were cured by operation.

10. Local recurrence of the disease occurred more frequently than recurrence in the lymphatic glands alone. In only one case did recurrence make its appearance at a period of more than three years after operation.

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